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ABSTRACT

Two kinds of research groups have evolved in higher education: one devoted to student learning and the other to teacher training. Both groups share a common interest in the development of student thinking and appear to be proceeding along parallel paths, which may be to their disadvantage. At the same time, some researchers in teacher training are attempting to link educational psychology and theories of learning, such as Piaget's work on cognitive development, to their research in order to provide a framework for devising improved teacher training techniques. Researchers at the University of Goteborg, Sweden, have abandoned this linkage and have based their work on the belief that learning must be considered in relation to the content which is the result of learning. They believe that effective teaching employs "cognitive empathy," which means that the teacher understands how students conceive of the principles and concepts in a particular subject. (Author/MH)

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UNDERSTANDING STUDENTS' UNDERSTANDING

Some qualitative aspects of the process and outcome of teaching and learning at university level

Paper presented at the 3rd EARDHE-congress, January 2-6, 1979, Klagenfurt, Austria

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During the last decade the general problem area of higher education has given birth to, among other scientific subsocieties, two quite distinguishable research communities: research on student learning and research on teacher training and staff development. In the two fields a number of documents have been published (cf. Entwistle & Hounsell 1976 on student learning and McKeachie on teacher training).

This development can be regarded as a symptom of an increasing interest in the internal life of universities from the educational perspective, a trend that, at least in Sweden, should be noted with great appreciation by the great number of people, not the least the many students, who accuse the university departments of their "didactical unawareness".

Furthermore, in the literature in this field, the two research communities are clearly identifiable for those who attend scientific congresses on higher education. Symposia titles such as "Student learning", "Methods for improving instructions", etc, are represented at almost every conference.

It is obvious that the two research areas share a considerable amount of interest in a common object of inquiry: the development of thinking in the student. There is, however, a risk that the two communities will proceed along different ways that more or less correctly will be perceived of as being parallell. In the following, the intention is to develop some arguments as to why such a development would be very disadvantageous.

Let us first state that the approach taken by an increasing number of researchers in the field of student learning is characterized by qualitative analysis of the process and outcome of learning and a stress of the context-dependency of knowledge about learning (Marton & Svensson 1979).

The research community in the field of teacher training and staff development appears to be somewhat more heterogeneous as concerns research approach and general perspective. Roughly speaking, there seem to be two main streams of interest in this area. On the one hand there is a lot of attention directed towards the social relations between students and teachers and their role among the basic prerequisites for teaching (Eckstein 1978, Huber 1976, Stanton 1978).

On the other hand several researchers have made considerable efforts in search of successful teaching methods in higher education in accordance with the classical method-comparing approach (McKeachie 1970). A number of key concepts, such as competency-based instruction, mastery learning, problem orientated teaching, etc, have been introduced or reintroduced into the vocabulary of education during the last 10-15 years.

The assumption about the nature of teaching competence underlying the latter tradition referred to is that a successful teacher (if we now disregard the social and personality aspects treated in the first tradition referred to above) has to have sufficient knowledge in the (a) subject matter areas and, besides, possess insight into the domain of (b) educational psychology. The notion is that in one way or another (b) should be applied to (a), i.e. the principles of educational psychology should be transposed into specific instances of contexts and contents.

There is, however, a continuously ongoing discussion about under what circumstances educational psychology can fulfill this function. One position in this matter is expressed by Glaser (1976), who writes that

> "I would like to speculate on the virtue of a 'linking science' - a psychology of instruction - between the scientific knowledge of learning (including human cognition and development) and educational application." (ibid p 2)

The tacit assumption behind this statement is the conviction that it is possible to achieve knowledge about the cognitive aspects of human functioning in learning situations that is context-independent. Evidently, Glaser also holds the position that such knowledge already exists to some extent.

Glaser refers to two different positions in the discussion about the applications of a theory of learning in instruction represented by Dewey and Thorndike.

Dewey held the same position as Glaser and argued for an intermediate science, while Thorndike was in favour of combining the theoretical and applied scientists in the same person.

In this question, we take the same standpoint as Thorndike and it is intended in the following to develop some arguments for this position.

A somewhat different way of apprehending the relationship between theories of learning and educational practice is developed by Hilgard & Bower (1975):

> "The naive view is that the basic researcher stocks a kind of 'medicine cabinet' with aids to solve the problems of the teacher. When a problem arises, the teacher can take a 'psychological principle' from the cabinet and apply it like a bandage or an ointment to solve the educational problem. It is increasingly recognized that in order to move soundly from basic research to practice we need a theory of application, which in this case is a theory of instruction to complement our theories of learning. A theory of instruction differs both in its goals and in its content from a theory of learning. It seeks to move beyond the descriptive and explanatory to the prescriptive, that is, to procedures to be recommended in practice." (ibid p 607)

The notion of some kind of linking science is implicit even in this quotation, but the theory of instruction is regarded more as a complement to theories of learning and is furthermore conceptualized in a more prescriptive way than is indicated in Glaser's version.

There is, however, no doubt that a lot of support has been mobilized for the emergence of a technological level between basic research in educational psychology and educational practice. In this respect several authors have presumably found their model in the relationship between biology and clinical medicine and between science and technology.

The existence of a relationship between educational psychology and education is often taken for granted. Already the word "educational" implies that this area should be of primary importance to the practical aspects of teaching.

Undoubtedly, it is also the case that many teachers or researchers interested in teaching problems have found theories of intelligence, development and learning a source from which they were able to scoop up valuable knowledge about how to design teaching methods.

One example is the steadily increasing interest in Piaget's work on cognitive development. Regarded on a superficial level, this state of affairs could be taken as strong support for the possibilites of a "linking science".

It is, however, interesting to speculate about why persons involved in practical teaching problems have paid such a lot of attention to a theoretical psychologist.

It is our conviction that the strong interest in Piaget's work shown by teachers primarily stems from the fact that Piaget, above all in his earlier work, has given very detailed and obviously also very valid descriptions of the content of childrens' thinking at various stages of their cognitive development. Through a massive amount of empirical work it has been possible to characterize childrens' conceptions of e.g. causal relationships, number, time, space, proportionality (e.g. Inhelder & Piaget 1958).

Piaget's goal was primarily beyond these descriptions, but judging from the perspective of an educational psychologist or a practioner in the field of teaching, the later publications of which the majority is of a more general kind are generally of a minor interest as compared to the earlier production.

In this sense, Piaget's earlier studies should not be regarded as a theoretical framework that can be linked to practice by some kind of linking science in Glaser's terminology. Rather, it is a kind of systematic study of practice without reducing what is characteristic of a specific instance (combination of individual and situation). Thus, this kind of scientific study of human functioning does not need any linkage to practice because it contains practice itself.

Another example of the nature of the relationship between science and practice is the case of connectionism and teaching/learning. The work of, above all, Skinner did not result in a theory in the common sense, but it was undoubtedly summarized in propositions about the phenomenon of learning that pretended to be valid for all instances of learning regardless of its content.

These general propositions contained some directly applicable prescriptions about how teaching and learning could best be improved and a number of concrete products and methodological acting rules were created.

In retrospect, it is obvious that the connectionistic conception of human learning was insufficient and partly erroneous. Nevertheless, it has had and still has a very large impact on teaching and learning in practice.

In our studies on learning in Göteborg, our work has been guided by the conviction that learning has to be studied by taking the content of its outcome into consideration. In this sense the approach has a lot in common with the early work by Piaget (Marton 1978).

Thus, our research has not aimed at formulating a general theory of learning. In this respect there is no "theory-practice-gap" in Glaser's sense that has to be overbridged by a linking science.

By taking a starting point in descriptions of how people conceive of various phenomena in the world around them, whether these conceptions be the result of identifiable learning situations or not, it is evident that the traditional conception of teaching competence that is seen as consisting of knowledge in educational psychology applied to a specific field of content, via some kind of linking science, is not adequate.

Our standpoint is that the most fundamental teaching skill is a kind of "cognitive empathy" that permits the teacher to understand how students conceive of the principles and concepts actualized in his field of study.

This understanding cannot be achieved by applying general laws of learning to specific cases, but can only be arrived at by gathering and systematizing experiences of how people think about the stratum of reality that is represented in a certain discipline.

Psychology as well as the subject matter area are both represented in this conception of teaching competence, but none of them in their traditional "pure" form. The linking science becomes superfluous by the

fact that the unit studied - the conception - consists of both theory and practice in the educational sense.

As opposed to the technical cognitive function of knowledge, we would rather assign the knowledge that is possible to achieve in this perspective to the emancipatory cognitive function in Habermas' (1972) terminology, i.e. rather than leaving rules of thumb for acting in different situations as offsprings of the kind of insight that builds up the cognitive empathy that permits a person to take alternative perspectives on his own situation and ways of acting. Thus, a consequence of understanding that might be considered as internal frames for education in the form of conceptions held by students might be a more general rise of awareness in the teacher that permits him to judge which teaching measures are suitable and which are not.

An empirical example

In a recently terminated research project on teaching and learning in economics at university level a number of studies were carried out on how principles and concepts in economics are conceived of by the students. A general outline of the project and some empirical findings are presented in Dahlgren & Marton (1977).

One of the studies carried out within the project concerned the effects of one term of university studies in economics on conceptions held about some everyday life economic phenomena such as price, taxes, money, inflation (Dahlgren 1978 a). It was concluded that

> "Qualitative changes of the students' conceptions about some phenomena brought to the fore in an introductory course in economics were found to be very marginal. The main change is instead of a terminological character." (ibid p 18)

Another study aimed at a description of the students' understanding of a number of concepts and principles that together and quantitatively take up a considerable part of the teaching and independent studies (Dahlgren 1978 b). Following temporally very close to the regular examination, an interview was carried out with a sample of students whereby some questions were put. A characteristic feature of these questions was that they were very difficult to answer in an algorithmic and non-

reflective way, i.e. they required a thorough understanding of the concepts and principles that they referred to. The outcome of the study is summarized as

> " ... it has been possible to show that if full understanding is required in order to answer the question, the result is quite different from the examination statistics.
>
> In many cases ... it appeared that only a minority of the students has apprehended basic concepts in economics in the way intended by teachers and textbook authors. Complex problems seem to be solved by application of memorized algorithmic procedures."
> (ibid p 11)

In economics, as in several disciplines characterized by a cumulative knowledge structure, it may be fatal for the understanding of more sophisticated problems treated within a discipline if crucial concepts on the elementary level are not understood. An example of this kind is the way in which students (not to say people in general) conceive of why commodities (goods and services) have a specific price and why peoples' incomes vary in size.

A model often used in the teaching of elementary economics is the so-called circular flow. In a simplified version it can be illustrated as in figure 1.

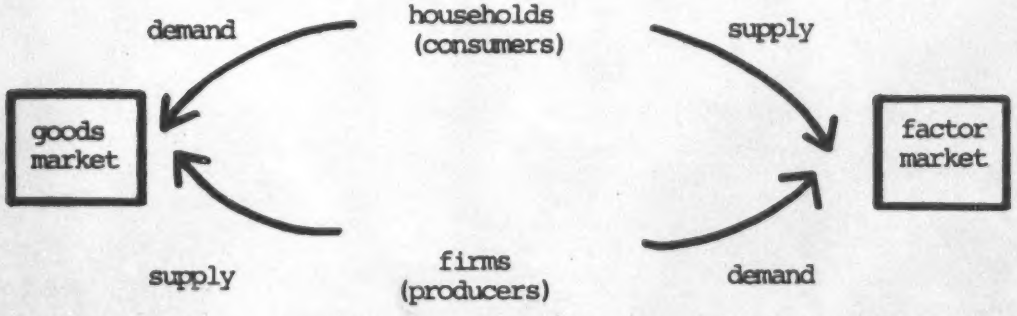

Figure 1.
A model of the circular flow in a competitive market economy

The basic principle in the model is that producers and consumers meet at two different markets to either sell or buy depending on which market is referred to. On the factor market the consumer sells his labour force, which is bought by the producer. The price of the labour force depends on the relationship between demand and supply for a specific kind of labour force (somewhat simplified). By tradition we denote the price that is agreed upon in this bargaining "a salary".

On the other market, the goods market, the roles have changed, meaning that the households have a demand for the commodities produced and supplied by the firms. As is the case on the factor market, prices on the consumption market are a function of the relationship between demand and supply.

In principle, prices and wages are system-determined entities and the role of the circular flow model is to give an idea of the dynamic character of the economic aspects of society. Prices and wages are, thus, to be regarded as abstract bearers of information about the existing relationship between demand and supply on two different markets.

It may, however, be noted that the circular flow model provides a very simplified picture of a market economy. Several complications have been introduced by the existence of trusts and cartels among the producers, by labour unions among their antagonists on the factor market and by a large number of taxes, regulations, subsidies etc, introduced by the state authorities.

The most frequent conception of prices and wages is, however, not the abstract demand-supply variant. By asking students about why a specific good has a specific price it was obvious that two qualitatively different ways of apprehending the price concept exist:

A The price is dependent on supply and demand.
B The price is equal to the value.
(cf. Dahlgren & Marton 1977, Dahlgren 1978 a)

The B-variant seems to dominate among people in general as well as among students of economics, at least among those who have taken an introductory course in the subject. Many B-answers are qualified by an addition that the price depicts the costs for production. Some

examples from interviews are indicative of the way of thinking:

"Why does a bun cost 50 öre?

S: It's the production value, what it costs to ...
E: Can you tell me what this price consists of? How it was established?
S: Well, the farmer must be paid for his flour so he refines it and sends it to the baker who refines the bun - or the grain into flour. (subject 8)
S: Well, the production cost, materials and labour, profit. (subject 5)"

In a later study (Dahlgren forthcoming) both prices and wages were actualized. The questions about the nature of wages were formulated:

"Why is it that peoples' salaries differ in size?"

It was obvious that the responses given to this question contained conceptions of three different kinds:

A The salary is an expression of the balance between demand and supply for labour forces of different kinds.
B The salary is an expression of the kind of requirement that is associated with a certain profession.
C The salary is an expression of a certain person's characteristics.

Categories B and C dominate very clearly in terms of frequency. It is interesting to note that to some extent the kind of qualitative differences found here are suggestive of those found among people's conceptions of price. The A-category is the same as the A-category in the question about the nature of price whilst the C-category in particular is similar to the B-category in the price question.

A basic feature of many students' conceptions of prices and wages is that these concepts are generally conceived of as tangible properties of the commodity (price) or of a person having a profession (wages).

The conception of price can also be said to be producer-oriented while the conception of wage is consumer-oriented. The relational nature of

these two system-determinated characteristics is thus not quite recognized. In a sense, this permits an understanding of what is the intuitive way of conceiving some economic concepts. At the same time this provides the starting-point for educational efforts. Intuitive conceptions of phenomena that are familiar to the beholder are probably very resistant to change (Dahlgren 1978 a). However, to know conceptions among students about phenomena treated in a course provides the teacher with the necessary basis for the "cognitive empathy" that we have considered above to be a major part of teaching competence.

Teaching - a kind of learning

Scientific disciplines which are related to changes in our surrounding world normally give birth to "technological" professions, i.e. linking scientists in the sense used by Glaser (1976).

The nature of this technological level is that it has its problems defined by the gap between the existing and the desired. Thus, the understanding of the existing prerequisites often plays a minor role compared to that which it is intended to achieve. The work of an engineer, for instance, very often means that a solution to a problem is a kind of "defeating" of the situation at hand.

At times, this has been a kind of model also in the field of teaching and education. During the era of educational and instructional technology most of the attention was paid to the goals in themselves and not to the prerequisites for achieving them.

It is our opinion that the offensive technological perspective should not be applied in teaching. Rather, we must devote considerably more effort to understanding the prerequisites for teaching - and learning - than we have done so far.

Teaching is a type of learning situation. In the teacher's perspective, that which has to be learned is that which is earlier learned by the learner.

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